A NATURAL HERITAGE INVENTORY OF THE CHEATHAM AND WORMLEY POND DRAINAGES, COLONIAL NATIONAL HISTORICAL PARK

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INTRODUCTION TO THE INVENTORY PURPOSE AND PROCEDURES

In August 1996, the Colonial National Historical Park, National Park Service, U. S. Department of the Interior, contracted the Virginia Department of Conservation and Recreation's Division of Natural Heritage (DCR-DNH) to conduct a Natural Heritage inventory of two park service properties. These properties include the Wormley Pond and Cheatham Pond drainages. The primary purpose of the inventory is to determine the presence of any plant and animal species listed as rare, threatened, or endangered by either the Federal or Virginia State government or determined to be candidates for listing by such agencies. This report details the findings of that inventory.

DNH is the state agency responsible by statutory authority under the Virginia Natural Area Preserves Act for inventory, database maintenance, protection, and management of Virginia's natural heritage resources. The Division provides the only comprehensive attempt to identify the Commonwealth's most significant natural areas through ongoing scientific biological survey. Data gathered during this state-wide survey is assembled and managed through a sophisticated Biological and Conservation Data System (BCD) in which information on ecosystems and species, their biology, habitats, locations, conservation status, and management needs is continually updated and refined. The Division is part of an international network of natural heritage programs, coordinated by The Nature Conservancy, which utilize standardized inventory methodologies and BCD technology

The intent of this inventory was to document the presence (or absence), distribution, and population status of specific elements of biological diversity. Bog twayblade (*Liparis loeselii*), mountain camelia (*Stewartia ovata*), sandpaper vervain (*Verbina scabra*) tidewater interstitial amphipod (*Stygobromus araeus*), tidewater amphipod (*Stygobromus indentatus*), Coastal Plain calcareous seepage swamp, and Dry Calcareous Forest/Woodland (Coastal Plain subtype) were determined to be the elements with the greatest potential to occur on the two study areas and were, therefore, the focus of this inventory. Other rare species and significant communities monitored by DCR-DNH, while not specific targets for this inventory, were also sought when appropriate habitat was encountered. The practical goal of this inventory is to assist park natural resource personnel in decisions concerning land use, maintenance activities, public access, siting of facilities, and management of areas containing natural heritage resources and exotic species of potential management concern.

The study areas are located along the York River on the Poquoson West, and Yorktown (Wormley Pond), Clay Bank, and Williamsburg (Cheatham Pond) U. S. Geological Survey (USGS) 7.5' topographic quadrangles in York County, Virginia.

EXPLANATION OF THE NATURAL HERITAGE RANKING SYSTEM

Each of the significant natural features (species, community type, etc.) monitored by the DCR-DNH is considered an element of natural diversity, or simply an **element**. Each element is assigned a rank that indicates its relative rarity on a five-point scale (1 = extremely rare; 5 = abundant; Table 1). The primary criterion for ranking elements is the number of occurrences (i.e., the number of known distinct localities or populations). Also of great importance is the number of individuals at each locality or, for highly mobile organisms, the total number of individuals. Other considerations include condition of the occurrences, number of protected occurrences, and threats. However, emphasis remains on the number of occurrences, so that ranks essentially are an index of known biological rarity. These ranks are assigned in terms of an element's rarity within Virginia (its State or S-rank) and the element's rarity over its entire ranges (its Global or G-rank). Subspecies and varieties are assigned a Taxonomic (T-) rank in addition to their G-rank. Taken together, these ranks give an instant picture of an element's rarity. For example, a rank of G5/S1 indicates an element which is abundant and secure range-wide, but extremely rare in Virginia. Ranks for community types are provisional or lacking, due to ongoing efforts by the Natural Heritage network to classify community taxa. Rarity ranks used by DNH are not legal designations, and they are continuously updated to reflect new information.

Table 1. Definition of Natural Heritage state rarity ranks. Global ranks are similar, but refer to a species' range-wide status. Note that GA and GN are not used and GX means extinct. Sometimes ranks are combined (e.g., S1S2) to indicate intermediate or somewhat unclear status. The letter Q, after the global rank denotes elements with uncertain taxonomic validity. Ranks for most community types have not been generated due to ongoing community classification efforts. These ranks should not be interpreted as legal designations.

S1	Extremely rare; usually 5 or fewer occurrences in the state; or may have a few remaining individuals; often especially vulnerable to extirpation.
S2	Very rare; usually between 5 and 20 occurrences; or few occurrences with many individuals; often susceptible to becoming endangered.
S3	Rare to uncommon; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
S4	Common; usually more than 100 occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.
S5	Very common; demonstrably secure under present conditions.
SA	Accidental in the state.
SH	Historically known from the state, but not verified for an extended period, usually more than 15

years; this rank is used primarily when inventory has been attempted recently.

SN Regularly occurring migrants or transient species which are non-breeding, seasonal residents. (Note that congregation and staging areas are monitored separately).

SU Status uncertain, often because of low search effort or cryptic nature of the element.

SX Apparently extirpated from the state

The spot on the landscape that supports a natural heritage resource is an **element occurrence**. DNH has mapped over 7,600 element occurrences in Virginia. Information on the location and quality of these element occurrences is computerized within the Division's BCD system, and additional information is recorded on maps and in manual files.

In addition to ranking each element's rarity, each element occurrence is ranked to differentiate large, outstanding occurrences from small, vulnerable ones. In this way, protection efforts can be aimed not only at the rarest elements, but also at the best examples of each. Species occurrences are ranked in terms of quality (size, vigor, etc.) of the population, the condition (pristine to disturbed) of the habitat, the viability of the population, and the defensibility (ease or difficulty of protecting) of the occurrence. Community occurrences are ranked according to their size and overall natural condition. These **element occurrence ranks** range from A (excellent) to D (poor). Sometimes these ranks are combined to indicate intermediate or somewhat unclear status (e.g., AB or CD, etc.). In a few cases, especially those involving cryptic animal elements, field data may not be sufficient to reliably rank an occurrence. In such cases a rank of E (extant) may be given. Element occurrence ranks reflect the current condition of the species' population or community. A poorly ranked element occurrence can, with time, become highly ranked as a result of successful management or restoration.

Element ranks and element occurrence ranks form the basis for ranking the overall significance of sites. Site **biodiversity ranks** (B-ranks) are used to prioritize protection efforts, and are defined as follows:

B1 Outstanding Significance: only site known for an element; an excellent occurrence of a G1 species; or the world's best example of a community type.

B2 Very High Significance: excellent example of a rare community type; good occurrence of a G1 species; or excellent occurrence of a G2 or G3 species.

B3 High Significance: excellent example of any community type; good occurrence of a G3 species.

B4 Moderate Significance: good example of a community type; excellent or good occurrence of state-rare species.

B5 General Biodiversity Significance: good or marginal occurrence of a community type or state-rare species.

Note: sites supporting rare subspecies or varieties are considered slightly less significant than sites supporting similarly ranked species.

The U.S. Fish and Wildlife Service (USFWS) is responsible for the listing of endangered and threatened species under the Endangered Species Act of 1973, as amended. Federally listed species (including subspecific taxa) are afforded a degree of legal protection under the Act, and therefore sites supporting these species need to be highlighted. USFWS also maintains a review listing of potential endangered and threatened taxa known as candidate species and species of concern. Table 2 illustrates the various status categories used by USFWS and followed in this report. The status category of species is based largely on the Service's current knowledge about the biological vulnerability and threats to a species.

In Virginia, two acts have authorized the creation of official state endangered and threatened species lists. One act (section 29.1-563 through 570, Code of Virginia), administered by the Virginia Department of Game and Inland Fisheries (VDGIF), authorizes listing of fish and wildlife species, excluding insects. The other act (section 3.1-1020 through 1030, Code of Virginia), administered by the Virginia Department of Agriculture and Consumer Services (VDACS), allows for the listing of plant and insect species. In general, these acts prohibit or regulate taking, possessing, buying, selling, transporting, exporting or shipping of any endangered or threatened species appearing on the official lists. Species protected by these acts are indicated as either listed endangered (LE) or listed threatened (LT). Species under consideration for federal listing are indicated as Species of Concern (SOC).

Table 2. U.S. Fish and Wildlife Service species status codes, with abbreviated definitions.

LE	Listed endangered
LT	Listed threatened
PE	Proposed to be listed as endangered
PT	Proposed to be listed as threatened
C	Candidate: status data supports listing of taxon as endangered or threatened, but listing has been delayed by pending proposals of higher priority taxa.

METHODOLOGY

Initial data collection began during the later part of 1996, including review of map resources (aerial photographs, soils maps, USGS topographic quadrangles), literature review, consultation with various taxonomic experts, and review of data within DCR-DNH's Biodiversity and Conservation Databases (BCD). Subsequently, DCR-DNH botanists, ecologists and zoologists assigned to the survey began preparations for fieldwork.

Field work began on 20 March 1997 with an initial reconnaissance of the areas to be surveyed at Wormley Pond by Gary P. Fleming (ecologist), Nancy VanAlstine (field botanist), and Chris Hobson (field zoologist). The results of DCR-DNH surveys conducted to date at Wormley and Cheatham Ponds are included in the following pages of this report.

OVERVIEW OF NATURAL HERITAGE INVENTORY METHODOLOGY

Division of Natural Heritage (DNH) staff conduct natural heritage inventories in a systematic and prioritized manner. In general, the most threatened geographic areas, habitats and species receive inventory priority. Adequately funded inventories carried out over several months or even years, typically allow for very intensive sampling of potential habitats. This may be carried a step further if sampling is confined to a restricted geographic area providing for a more focused survey.

Natural heritage inventories usually are conducted in six basic stages:

1. Review of aerial photographs and maps. Aerial photographs of the entire survey area are reviewed in detail to identify potential natural areas to be studied in subsequent stages. When possible, both the oldest available photographs and the most recent ones are examined. Comparing these two sets of photographs helps determine how long forests and other vegetation types have been in their current condition. To aid in their interpretation, the photographs are cross-referenced with topographic, wetlands, and soils maps.

2. Review of existing information. DNH staff visits museum collections, and specimen label information is recorded for rare species. Published and unpublished information on natural areas within the inventory area is collected and assimilated in conjunction with review of aerial photographs. Maps of lands within the survey area are gathered, BCD databases are accessed, and the known distribution of natural heritage resources is examined. Local naturalists, soil conservationists, foresters and college faculty often are consulted for additional information. During this stage, some potential natural areas are eliminated from further consideration while others are added.

3. Aerial reconnaissance. When possible, selected potential natural areas are studied in more

detail by aerial reconnaissance using small aircraft.

4. Initial ground survey. Initial ground reconnaissance is conducted in targeted, high priority sites. During this stage, land use activities are assessed, conspicuous element occurrences are documented and, if necessary, follow-up visits are planned.

5. Thorough inventory of the site. During this stage, detailed information is collected on the rare species and exemplary natural communities present at a site. Portions of a site not visited on foot are evaluated on the basis of aerial photographs and other information. The area of land needed to protect the special biological features is determined. Threats and past or present disturbances are also evaluated. Element occurrence data are transcribed onto DNH maps and entered into the BCD system. Throughout this stage of concentrated field inventory, continual communication between DNH project team members (botanists, zoologists, and ecologists) is emphasized to ensure that all significant natural areas are visited by appropriate specialists and that data are coordinated. In addition, some flexibility is built into the process so that priorities can be adjusted when unexpected elements are encountered.

6. Compilation of results and preparation of final report. As fieldwork is completed, DNH biologists review the information gathered and rank sites according to their ecological significance. Maps are drawn showing preliminary conservation planning boundaries, and protection and management recommendations are written. These are combined with site reports and other required information in preparing a final report.

The materials and methodology employed by the major disciplines in carrying out the inventory of the Cheatham and Wormley Pond study areas are summarized as follows:

BOTANICAL INVENTORY

For purposes of this study, rare plants are defined as the rarest known species in the Commonwealth. They include species with global ranks of G1, G2, and G3, and state ranks of S1, S2, S3, SH, SX, and SU. Data on species with state ranks of S1, S2 (or S2S3), SH, and SX are maintained in the BCD system and summarized annually on a master list of Virginia's rare plants. Species with state ranks of S3 and SU are not tracked using BCD, but maintained on a separate "watchlist." Only general information about watchlist species is recorded in the field and maintained in manual information files.

To initiate the inventory of rare plants within the study areas at CNHP, existing data on element occurrences within and near the study areas were obtained from the BCD database and reviewed. Additional information was gathered from botanical literature and from examination of collections at the following institutions: College of William and Mary, George Mason University, Longwood College, Lynchburg College, National Arboretum, Old Dominion University, University of Richmond, U.S. National Herbarium (Smithsonian Institution), University of North Carolina, Virginia Commonwealth University, and Virginia Polytechnic

Institute and State University.

Preliminary research identified two previously documented rare plants, including bog twayblade (*Liparis loeselii*) and mountain camelia (*Stewartia ovata*) within the Cheatham Pond study area. Both of these species are Mountain-Coastal Plain disjuncts associated with calcareous soils, which are prevalent in the Cheatham Pond area. BCD did not contain any previously recorded rare plant occurrences within the Wormley Pond study area. However, a student at the College of William and Mary working at Wormley Pond documented a small population of sandpaper vervain (Verbena scabra) in 1992. Other rare plants that could potentially occur within the study areas include Virginia least trillium (*Trillium pusillum* var. *virginianum*), fibrous bladderwort (*Utricularia striata*), Cuthbert turtlehead (*Chelone cuthbertii*), sweet pinesap (*Monotropsis odorata*), lax hornpod (*Mitreola petiolata*), and American wisteria (*Wisteria frutescens*). These potential rare species, and those previously documented, were the focus of botanical field investigations conducted in 1997 within the study areas.

Information on the landscape within the study areas was gathered through examination of aerial photographs, geologic maps, topographic maps and soil surveys. These sources were examined to delineate the distribution of plant habitats and to identify sites with high potential for rare species occurrences. Data compiled on the rare plant records, along with information on the distribution of plant habitats, was used to formulate field plans and prioritize field investigation.

In late 1996 and early 1997, DCR-DNH botanists met to develop field plans for the upcoming field seasons. During planning meetings, aerial photographs and topographic maps were re-examined to ensure that those areas most likely to support rare plants were checked. During the field investigations, communication between field botanists, ecologists, zoologists and NPS personnel ensured that new data were shared and that all significant rare plant habitats were investigated.

Botanical fieldwork began in March 1997. Habitat for potential rare plant species within the study areas was surveyed during the appropriate season for the target species. Additionally, the locations of exotic plant species were noted within those areas surveyed. Field botanist Nancy Van Alstine was responsible for the fieldwork, with considerable contributions also coming from DCR-DNH ecologist Gary P. Fleming.

During the botanical investigation, field data were recorded during each site survey and were coordinated with data collected from the same site by ecologists and zoologists. These data included the site location, directions, and a site description, as well as comments on land use, potential hazards, exotic flora and fauna, and off-site considerations. When rare plant occurrences were located, additional data were recorded, including the date(s) when the species was found, population boundaries and concentrations within those boundaries, approximate number of individuals, reproductive and phenological status, and species viability. Habitat factors such as moisture, light and associated species, as well as any apparent immediate or long-term threats to the rare species population were also noted. Photographs were taken or voucher

specimens were collected to verify the identity of all rare species, and each occurrence was ranked on the basis of all available data. Common and scientific names used for plants in this report follow Weakley (1997).

ZOOLOGICAL INVENTORY

For purposes of this study, rare animals are defined as the rarest known species in the Commonwealth. They include species with global ranks of G1, G2, and G3, and state ranks of S1, S2, S3, SH, SX, and SU. Data on species with state ranks of S1, S2 (or S2S3), SH, and SX are maintained in the BCD system and summarized annually on a master list of Virginia's rare animals. Species with state ranks of S3 and SU are not tracked using BCD, but maintained on a separate "watchlist." Only general information about watchlist species is recorded in the field and maintained in manual information files.

To initiate inventory of rare animals within the study areas at CNHP, existing data on element occurrences within and near the study areas were obtained from the BCD database and reviewed. Additional information was gathered from zoological literature and from examination of selected collections at the following institutions: U.S. Museum of Natural History, the Carnegie Museum of Natural History, Lord Fairfax Community College, Eastern Mennonite College, Old Dominion University, Virginia Polytechnic Institute and State University, Virginia Commonwealth University, and the Virginia Museum of Natural History.

This preliminary research indicated that no rare animal occurrences were known from either the Wormley Pond or Cheatham Pond study areas. Several species have been documented in areas with similar habitats in the vicinity of these study areas, and those species, including the tidewater interstitial amphipod (*Stygobromus araeus*), and the tidewater amphipod (*S. indentatus*) were the focus of zoological field investigations conducted in 1997.

In late 1996 and early 1997, aerial photographs and various map sources were consulted to determine the extent of potential rare animal habitats. Subsequently, a field plan, based on all the available preliminary information, was developed to direct investigation of potential rare species habitats for all animal groups.

Fieldwork was initiated in March 1997 and continued through October, 1997. These investigations, which covered birds, mammals, amphibians, reptiles, odonata (dragonflies and damselflies), butterflies, and other invertebrates, required repeated visits to several sites and potential habitats at different seasons. DNH zoologists Christopher S. Hobson, and Anne C. Chazal were responsible for the work.

A variety of inventory and sampling methods were employed by the team's zoologists:

Sweep nets - butterflies, odonates, tiger beetles, and other flying invertebrates were sampled in terrestrial and aquatic habitats using sweep nets.

Hand collection - reptiles and amphibians, as well as some invertebrates, were collected by hand.

Transects were walked through terrestrial habitats, where various cover objects were overturned in search of cryptic species

Bird surveys - Surveys for avifauna at Wormley and Cheatham Ponds included visual survey techniques, and listening for target bird species in suitable habitats during appropriate seasons.

As in the botanical inventory, complete data were recorded for each site surveyed and additional data were recorded when rare animal occurrences were located. In cases where these sites were also visited by botanists and ecologists, the data were coordinated. All occurrences were ranked on the basis of available field data.

COMMUNITY INVENTORY

The need to protect rare species is generally well understood and appreciated, but the need to protect indigenous biotic communities sometimes requires explanation. Community classification, inventory, and protection should be regarded as an essential complement to rare species inventories. Communities represent functioning units of the landscape which:

1. support myriad life forms too cryptic or poorly known to be catalogued and prioritized individually;

2. provide habitat for both rare and common species;

3. contribute to the maintenance of larger ecosystems, and

4. possess unique intrinsic scientific, educational, and aesthetic values.

It is therefore important to locate, classify and evaluate these features as part of any comprehensive inventory of natural heritage resources.

Most community types have not yet been fully defined or ranked due to ongoing classification efforts by The Nature Conservancy and the network of natural heritage ecologists. In Virginia, the current definition of communities is at a broad, natural community group level. Classification at the natural community level groups together community types with similar structural, floristic, and habitat similarities, *e.g.*, dry oak-hickory forests. A few community types, which have been quantitatively sampled and studied intensively by DCR-DNH ecologists, have been formally classified at the association level. Units at this level are defined by a high degree of floristic and environmental similarity, and are named using diagnostic species of the association, e.g. the *Pinus serotina* / *Lyonia lucida* -*Kalmia carolina* (Pond Pine / Shining Fetterbush -Carolina Sheep-Laurel) Saturated Sparse Woodland. The ongoing goal of Division ecologists is a comprehensive classification of Virginia's communities at the association level.

For the purposes of this study, significant communities are defined to include both outstanding examples of common community types and all examples of rare community types. Refer to

Appendix 3 for the preliminary DCR-DNH classification of natural community groups.
The community portion of the inventory began with a review of BCD database information and scientific literature. Based on this review, it was determined that two significant communities had been previously documented from the Cheatham Pond study area. No significant communities were documented previously from the Wormley Pond study area.

Based on known information about the area, it was also determined that the types of significant communities with the highest potential to occur in Colonial National Historical Park were:

- Coastal Plain Calcareous Seepage Swamp: groundwater-saturated forests occurring in the bottoms of ravines with calcareous soils derived from underlying Pliocene shell deposits. In Virginia, such communities are confined to inland portions of the middle and lower Peninsulas, and dissected topography along the southeast side of the James River and its tributaries in Surry and Isle of Wright Counties.

- Basic Mesic Forest: rich, mixed hardwood forests occupying the more sheltered, mesic slopes of calcareous ravines. Indicator species usually include southern sugar maple (*Acer barbatum*), umbrella magnolia (*Magnolia tripetala*), leatherwood (*Dirca palustris*), and a number of herbaceous montane disjuncts.

- Dry Calcareous Forest / Woodland (coastal plain subtype): open forests or woodlands occupying the more exposed, south or west-facing convex slopes of calcareous ravines. These habitats usually have abundant shell fragments exposed by sheet erosional processes and support a number of very unusual species for the coastal plain. Chinkapin oak (*Quercus muehlenbergii*) is usually the key indicator species.

Ecological fieldwork was conducted by DCR-DNH Vegetation Ecologist Gary P. Fleming between April 24 and October 6, 1997. During this period, intensive exploration of high potential habitats was carried out throughout the Cheatham and Wormley Pond Study areas. Complete standard information was collected from each site visited and was coordinated with data collected by botanists and zoologists. When significant communities were located, additional data were collected on occurrence size, condition, boundaries, biotic and abiotic factors, floristics, evidence of disturbance, successional trends, and immediate or long-term threats. Primarily they're quality and size ranked community occurrences.

INVENTORY RESULTS SUMMARY

During surveys at the Cheatham and Wormley Pond study areas, several rare species occurrences were documented. These occurrences are summarized below. Exemplary natural communities and rare plant and animal species targeted for these surveys are listed in Appendix 1.

Zoological Inventory

Zoological surveys yielded two populations of the globally rare (G2 S2) tidewater interstitial amphipod *Stygobromus araeus*. A deeply cut ravine in the southwestern portion of the Cheatham Pond study area held numerous seepage habitats. *Stygobromus araeus* was found in four of these seepage's (Figure 7). At Wormley Pond, only one occurrence of this amphipod was documented in a small ravine along the northern arm of the pond adjacent the northern entrance road (Figure 12). The DCR-DNH watchlist amphipod species *Gammarus pseudolimnaeus* was also documented in several small streams and seeps throughout both study areas. No other rare or watchlist animal occurrences were documented during the inventory. A list of common and widespread species noted during zoological surveys can be found in Appendix 2.

Botanical Inventory

Rare plants were found at both the Cheatham and Wormley Pond study areas. Two rare plant species were previously documented at Cheatham Pond, including bog twayblade (*Liparis loeselii*) and mountain camelia (*Stewartia ovata*). One previously documented occurrence of the state rare plant sandpaper vervain (*Verbena scabra*), was recorded at the Wormley Pond study area. Additional information on rare plant occurrences within the study areas is available in the following site reports.

Surveys conducted at Cheatham Pond in 1997 did not identify any new occurrences of bog twayblade (*L. loeselii*), however, the species was reverified at two previously documented sites (Figure 8). The previously documented occurrence of mountain camelia (*S. ovata*) was also reverified, but only one snag was located (Figure 9). No new rare plant occurrences were documented at the Cheatham Pond study area.

One new occurrence of lax hornpod (*Mitreola petiolata*) was documented (Figure 13), and several new sub-occurrences of the previously documented sandpaper vervain (*Verbena scabra*) were found (Figure 14) at the Wormley Pond study area during 1997 surveys.

Community Inventory

Several occurrences of exemplary natural communities were documented as a result of 1997 inventory efforts. Detailed information on these community occurrences and those previously recorded can be found in the following site reports.

At the Cheatham Pond study area, two occurrences of Coastal Plain Calcareous Seepage Swamp communities (one with 5 smaller sub-occurrences), and one occurrence of Dry Calcareous Forest / Woodland (coastal plain subtype) were documented (Figures 5,6). The southwestern most occurrence of Coastal Plain Calcareous Seepage Swamp and the Dry Calcareous Forest / Woodland (coastal plain subtype) occurrence had been documented previously.

At Wormley Pond, one occurrence (with three sub-occurrences) of Dry Calcareous Forest / Woodland was documented (Figure 11). This occurrence is one of the most outstanding examples of this community type ever documented in Virginia. No other exemplary communities were documented within the Wormley Pond area.

INTRODUCTION TO THE SITE REPORTS

To facilitate management and enhance protection of biodiversity within the study areas at Cheatham and Wormley Ponds and within the Colonial National Historical Park properties, boundaries have been provided for landscape units, which merit practical and justifiable recommendation as conservation sites. A conservation site is a natural area that includes one or more element occurrences and has been assigned a biodiversity rank of at least B5. Reports follow for two conservation sites identified during the natural heritage resource inventory. The following standard reporting format is used for each conservation site identified within the survey area.

SITE NAME: Site names typically reflect a geographic locality and, in some cases, a prevalent landscape features.

SIZE: The approximate acreage within the conservation planning boundary, as determined by planimeter, is given.

BIODIVERSITY RANK: The overall significance of the natural area, in terms of the rarity of natural heritage resources and the quality of their occurrences, is indicated. As described in section I, these ranks range from B1 (very high significance) to B5 (general biodiversity significance).

LOCALITY: The county (or counties) containing the site is listed.

QUADRANGLE: The name of the USGS 7.5' quadrangle(s) that includes the site is listed.

QUADRANGLE CODE: The code used by DNH for the quadrangle is listed. The first five digits of the code represent latitude and longitude (in degrees) of the quadrangle.

LOCATION: Location of the site within the drainage and distance from some geographic landmark is given.

NATURAL HERITAGE RESOURCE SUMMARY TABLE: This field provides a synopsis of the natural heritage resources (rare species and significant communities), together with their status ranks (global, state, USFWS and Virginia legal) and element occurrence ranks.

SITE DESCRIPTION: A brief narrative describing the site, it's significant elements, vegetation, habitat, and current land use is presented.

BOUNDARY JUSTIFICATION: The preliminary conservation planning boundary delineated in this report contains all known occurrences of natural heritage resources and adjacent lands required for their immediate protection. This information field explains the basis for the specific site boundaries.

THREATS: Threats to the site and its natural heritage resources are described. These may include both real, imminent threats and potential threats posed by types of land use activities or other factors that currently are not impacting the site.

MANAGEMENT RECOMMENDATIONS: This field is a summary of the major issues and factors that should be considered in management of the site for its biodiversity and natural heritage resource values. As a rule, generalized recommendations are provided based on potential threats identified during the survey work. The expertise of inventory biologists familiar with each site, as well as input from DNH natural areas program biologists has been utilized in preparing these recommendations. However, within the context of a relatively short-term (two year) inventory effort on large sites, it may be difficult to identify highly specific management strategies. In addition, the management needs of a few element occurrences are so obscure that additional study by experts may be needed. In many cases, monitoring of element occurrences or site factors is recommended to determine the best long-term management practices. In all cases, if land use changes or specific high-impact actions are proposed within a site's boundary, consultation with DNH staff is recommended to assess impacts on the natural heritage resources.

PROTECTION RECOMMENDATIONS: A summary of the actions and priority needed to ensure long-term protection of the site and its elements are provided.

REFERENCES: Pertinent literature and sources cited within the site report are listed.

SITE MAP: The site map, drawn on a copy of the USGS 7.5' quad(s), shows the preliminary conservation planning boundary which contains all known element occurrences and the land determined to be important for long-term maintenance of the elements. The following factors are considered when drawing these boundaries:

- the extent of current and potential habitat for rare species and exemplary natural communities;

- species movement and migration corridors;

- maintenance of surface water quality within the site and the surrounding watershed;

- maintenance of the hydrologic integrity of groundwater resources;

- land intended to mitigate a wide variety of off-site impacts;

- land or activities necessary to preclude or minimize exotic species; and

- land necessary for management activities (e.g., prescribed burning).

The boundaries are intended for conservation planning purposes and, at the very least, should prevent inadvertent damage to the natural areas.

ELEMENT LOCATION MAPS: Maps showing the exact location of each element occurrence within a site are included following the Site Map. In the case of animal elements, which are often highly mobile organisms, the maps indicate where actual collections were made and/or specimens were observed. These location maps are intended to provide resource managers with requisite site-specific information. However, since rare species are often sensitive to disturbance or may be sought out by collectors, we strongly recommend that this information not be shared with the general public or with persons not directly involved in the stewardship of these sites.

CHEATHAM ANNEX WEST

SIZE: ca. 557 acres **BIODIVERSITY RANK:** B3

LOCALITY: York County, Colonial National Historical Park

QUADRANGLE: Clay Bank/Williamsburg **QUADRANGLE CODE:** 3707635/3707636

LOCATION: This site is located within National Park Service Land on the west side of Cheatham Pond in York County, Virginia. The site lies entirely to the north of Interstate 64 on the East Side of Queens Creek, and is part of an NPS inholding within Cheatham Annex Naval Facility.

NATURAL HERITAGE RESOURCES SUMMARY TABLE

COMMON NAME & SCIENTIFIC NAME	GLOBAL RARITY RANK	STATE RARITY RANK	USFWS STATUS	VA. LEGAL STATUS	ELEMENT OCCURRENCE RANK
Communities:					
-Coastal Plain Calcareous Seepage Swamp	G?	S2			C
-Coastal Plain Calcareous* Seepage Swamp	G?	S2			BC
-Dry Calcareous Forest/Woodland (Coastal Plain subtype)**	G?	S1			CD
Animals:					
-*Stygobromus araeus* Tidewater interstitial amphipod	G2	S2		SC	C
Plants:					
-*Liparis loeselii** bog twayblade	G5	S2			B
-*Liparis loeselii* bog twayblade	G5	S2			B
-*Stewartia ovata* mountain camelia	G4	S2			D

* = ONE ELEMENT OCCURRENCE WITH SUBOCCURRENCES
** = FORMERLY REFERRED TO AS CHINKAPIN OAK WOODLAND

SITE DESCRIPTION: This site consists of a series of ravines and adjacent forested uplands to the west of Cheatham Pond. Ravines on the western section of the site empty into a tributary of Queen Creek whereas those on the east side flow into Cheatham Pond, an artificial impoundment. Ravines on the western side of the site are more deeply cut than those on the east side. In general the upland consists of predominantly hardwood forest in various successional

stages, but mostly less than 50 years old and containing occasional loblolly pine. Unpaved perimeter and internal roads cut through the upland forest and across ravines. Several of the deeper ravines within the site contain mixed hardwood forests of considerable age, with some trees more than 100 years old.

Many of the ravine bottoms and lower slopes are underlain by the fossil rich (shells) Yorktown Formation creating basic conditions favorable for the significant communities and calciphilic plant species, including rigid sedge (*Carex tetanica*), marsh marigold (*Caltha palustris*), drooping bulrush (*Scirpus lineatus*), swamp lousewort (*Pedicularis lanceolata*), and shadow-witch orchid (*Ponthieva racemosa*). Ravines in the southeastern section of the site contain an occurrence (with 5 sub occurrences) of Coastal Plain calcareous seepage swamp characterized by the green ash (*Fraxinus pennsylvanica*) / smooth bur-marigold (*Bidens laevis*) - blackfruit clearweed (*Pilea fontana*) - drooping bulrush (*Scirpus lineatus*) association. A ravine bottom in the southwestern corner of the site supports a small example of the same community type. A small occurrence of a possibly globally rare, but little known community, Dry Calcareous Forest/Woodland (Coastal Plain subtype), is located in the northwest corner of the site.

The globally rare tidewater interstitial amphipod (*Stygobromus araeus*) was found in multiple seepage's in this same ravine. Holsinger (1978) states that *S. araeus* occupies groundwater seeps, small springs and small, seep-fed streams emerging from loosely consolidated and unconsolidated Coastal Plain sediments (upper Miocene and Pliocene-Pleistocene in age) in southeastern Virginia. This species has been recorded only in southeastern Virginia and extreme northeastern North Carolina, with a majority of the records coming from Virginia.

Two occurrences of the state rare bog twayblade (*Liparis loeselii*) are located within the site: two adjacent ravines on the west side of the site contain subpopulations of one occurrence which consisted of a total of 16 plants in 1989, but only 1 plant in 1997. Another bog twayblade occurrence is found on the eastern side of the site in a lower stream bed and on hummocks within the mucky area where a small stream enters a branch of Cheatham Pond; as many as 54 stems have been previously documented in this population. A single individual of the state rare mountain camelia (*Stewartia ovata*) was documented in 1989 on a peninsula overlooking one of the impoundments on the west side, but this individual is suspected to have died since and no additional shrubs have been found at this site.

BOUNDARY JUSTIFICATION: The conservation planning boundary includes all of the natural heritage resources and watchlist species found within this site during 1997, as well as those species and communities occurring within the boundary and contained in the Biological and Conservation Data System prior to the initiation of 1997 field surveys by DCR-DNH. The boundary also encompasses a buffer zone of adjacent habitat, which is designed to ensure the viability of the resources within this site.

THREATS: Natural Heritage resources at this site may be threatened by a number of potential or existing problems contributing to declining water quality, including increased sedimentation,

siltation, pollution, and alteration of the hydrologic regime. Alteration of forested habitats may also threaten the rare species and communities within this site through invasion by exotic flora and fauna, changes in nutrient inputs, erosion leading to increased sediment loads, and other potentially detrimental factors. Threats to the quality of the site for rare plants arise from invasive alien plant species, particularly eulalia that is especially abundant in the ravine bottoms. Heavy deer browsing may also threaten the integrity of natural communities and the viability of rare plant populations. Clark and Rafkind (1997) provide additional information on threats to the occurrences of bog twayblade, mountain camelia, and the Dry Calcareous Forest/Woodland (Coastal Plain subtype) community within this conservation site.

MANAGEMENT RECOMMENDATIONS: Monitor all bog twayblade sites, including sites in which the plant was not seen in 1997, as populations may fluctuate widely or not even appear in a given year. Monitor populations of amphipods and water quality periodically. The invasive alien grass, eulalia, may be the most serious threat to the integrity of the significant communities and the long-term viability of the bog twayblade populations. It might be possible to hold the eulalia populations to reduced levels in the specific bog twayblade sites, but reducing it in the seepage swamps is not feasible. Deer browsing was observed to be heavy in the uplands, but not as severe in the ravine bottoms. Clark and Rafkind (1997) provide a more detailed monitoring schedule and protocol for natural heritage resources addressed in their Conservation Plan for the larger but inclusive "Cheatham Ravines Natural Area."

PROTECTION RECOMMENDATIONS: This site merits protection due to the presence of one globally rare animal species, three exemplary natural communities, two rare plant species and several watchlist plants and animals. Avoid direct disturbance to seepage habitats and upslope disturbances such as timber harvest, which may alter the hydrologic regime or add sediment to streams or ravines supporting the significant communities, rare plants and amphipod populations. Refer to Clark and Rafkind (1997) for additional information on protection recommendations regarding elements within this conservation site.

REFERENCES:

Clark, K. H., and C. Rafkind. 1997. Conservation Planning for the Natural Areas of Colonial National Historical Park, Virginia -- DRAFT 5. Natural Heritage Technical Report 97-04. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia. 105 pp. plus 6 appendices.

WORMLEY POND

SIZE: ca. 158 acres **BIODIVERSITY RANK:** B2

LOCALITY: York County, Colonial National Historical Park

QUADRANGLE: Poquoson West/Williamsburg

QUADRANGLE CODE: 3707624/3707625

LOCATION: The site is located in Colonial National Historical Park southeast of Yorktown National Cemetery and just west of the U. S. Naval Supply Center, approximately 2.0-2.5 miles north of Battle Park.

NATURAL HERITAGE RESOURCES SUMMARY TABLE

COMMON NAME & SCIENTIFIC NAME	GLOBAL RARITY RANK	STATE RARITY RANK	USFWS STATUS	VA. LEGAL STATUS	ELEMENT OCCURRENCE RANK
Communities:					
-Dry Calcareous Forest/Woodland (Coastal Plain subtype)*	G?	S1			B
Animals:					
-*Stygobromus araeus* Tidewater interstitial amphipod	G2	S2		SC	CD
Plants:					
-*Mitreola petiolata* lax hornpod	G5	S1			C
-*Verbena scabra** sandpaper vervain	G5	S2			B

* = ONE ELEMENT OCCURRENCE WITH SUBOCCURRENCES

SITE DESCRIPTION: Site consists of an old millpond situated in a deep, coastal plain ravine system. Downcutting of the ravines has exposed calcareous Pliocene shell beds of the underlying Yorktown formation, which is visible in many places on the steeper slopes flanking the pond. Wetland habitats of the site include open water in the lower pond, emergent freshwater marshes in the upper portion of the pond, and saturated bottomland forests in the uppermost pond branches and tributaries. A sizeable area of uplands occupied by nearly monospecific loblolly pine stands and regularly mowed field's surrounds the pond and its feeder ravines. Mixed hardwood forests occupy the pond slopes and portions of uplands not dominated by pine. A number of noteworthy calciphilic plants, e.g. eastern hophornbeam (*Ostrya virginiana*), crested

coralroot (*Hexalectris spicata*), Robins-plantain (*Erigeron pulchellus*), wild columbine (*Aquilegia canadensis*), that are components of a rare type of dry calcareous woodland, occur on the steep slopes around the pond. Two rare plant species, sandpaper vervain (*Verbena scabra*) and lax hornpod (*Mitreola petiolata*), occur on wet pond shores, while the rare groundwater amphipod *Stygobromus araeus* was found in a spring seep on the slope of the northernmost arm of the pond. Holsinger (1978) states that *S. araeus* occupies groundwater seeps, small springs and small, seep-fed streams emerging from loosely consolidated and unconsolidated Coastal Plain sediments (upper Miocene and Pliocene-Pleistocene in age) in southeastern Virginia.

The occurrence of Dry Calcareous Forest/Woodland (coastal plain subtype) at Wormley Pond is one of the best examples of this community ever documented. Probably globally rare and endemic to eastern Virginia, this community type is typically developed only in very small patches. The occurrence at this site consists of three stands separated by natural topographic factors. Mature, somewhat gnarled chinkapin oak (Quercus muhlenbergii) and southern sugar maple (Acer barbatum) characterize the community. Dominant small trees and shrubs include redbud (*Cercus canadensis*), flowering dogwood (*Cornus florida*), and eastern hophornbeam (*Ostrya virginiana*), with herbaceous dominants of white crownbeard (*Verbesina virginica*), long-bristled indian grass (*Sorghastrum elliotti*), Bosc's panic grass (*Dichanthelium boscii*), variable panic grass (*Dichanthelium commutatum*), shiny wedge grass (*Sphenopholis nitida*), narrow-leaved blue-eyed-grass (*Sisyrinchium angustifolium*), and Pennsylvania sedge (*Carex pennsylvanica*). The flora reflects the strong influence of the underlying, shell-rich Yorktown formation.

BOUNDARY JUSTIFICATION: The boundary encompasses key habitats supporting the rare community type and rare species, and a buffer zone sufficient to mitigate immediate on-site impacts.

THREATS: Natural Heritage resources at this site may be threatened by a number of potential or existing problems associated with water quality and quantity, including increased sedimentation, siltation, pollution, and alteration of the hydrologic regime. Alteration of forested habitats may also threaten the rare species and communities within this site through invasion by exotic flora and fauna, changes in nutrient inputs, erosion leading to increased sediment loads, and other potentially detrimental factors. Threats to the quality of the site for rare plants arise from invasive alien plant species, particularly eulalia (*Microstegium vimineum*) which is especially abundant in the ravine bottoms, and common reed (*Phragmites australis*) which is established in several sizeable colonies in freshwater marshes in the upper reaches of the pond and may displace native species. The exotic basket grass (Arthraxon hispidus) may threaten populations of sandpaper vervain. Heavy deer browsing may also threaten the integrity of the natural community and the viability of rare plant populations. Beavers pose a significant threat to the long-term viability of significant woodlands surrounding the pond. The threat to the rare community is immediate. Alteration of the existing road right-of-way in the vicinity of the rare amphipod population could adversely affect the amphipods and may effect the ability to detect their presence.

MANAGEMENT RECOMMENDATIONS: Trapping out or otherwise eliminating beaver from the pond will ensure the long-term viability of significant woodlands surrounding the pond. Beavers have already begun to affect the integrity of the exemplary natural community occurrence at this site by felling a significant number of trees within the community and in adjacent areas. The habitat of *Stygobromus araeus* should be monitored periodically to determine usage throughout the year and to detect negative changes to groundwater quality and quantity. Upslope timber harvests and alteration to the adjacent road right-of-way may negatively impact the seepage habitat where the amphipod population was discovered, and should be avoided. Refer to Clark and Rafkind (1997) for information on management recommendations at other sites within Colonial National Historical Park, which may have similar habitats, plants, and animals.

PROTECTION RECOMMENDATIONS: This site merits protection due to the presence of one globally rare animal species, one exemplary natural community, two rare plant species, and several watchlist plants and animals. Avoid direct disturbance to seepage habitats and upslope disturbances such as timber harvest, which may alter the hydrologic regime or add sediment to streams or ravines supporting the significant communities, rare plants and amphipod populations.

REFERENCES:

Clark, K. H., and C. Rafkind. 1997. Conservation Planning for the Natural Areas of Colonial National Historical Park, Virginia -- DRAFT 5. Natural Heritage Technical Report 97-04. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia. 105 pp. plus 6 appendices.

Exotic species

Distributional data gathered for exotic plant and animal species includes only those data collected from areas in which surveys were conducted by DCR-DNH field staff during 1997. Figures 1-2 show the locations of observed populations of common reed (*Phragmites australis*) and Chinese privet (*Ligustrum sinense*) within the Cheatham Pond and Wormley Pond survey areas. Two exotic plant species including eulalia (*Microstegium vimineum*) and Japanese honeysuckle (*Lonicera japonica*) were found to be ubiquitous throughout the study areas. Other exotic species such as garlic mustard (*Alliaria petiolata*), autumn olive (*Elaeagnus umbellata* var. *parvifolia*), Beale's oregon-grape (*Mahonia bealei*), basket grass (*Arthraxon hispidus*), English ivy (*Hedera helix*), and oriental hawksbeard (*Youngia japonica*) were not found to be common in the surveyed areas, but are likely to be more widespread than survey results indicate. All of these species are rated as "highly invasive" on the Invasive Alien Plant Species of Virginia list (DCR-DNH, 1996).

Belden et al. (1995) mentioned several of these exotic species, including *M. bealei*, *M. vimineum*, *Ligustrum* spp., and *L. japonica* as occurring within surveyed parcels along Yorktown Creek within Colonial National Historical Park. Clark and Rafkind (1997) stated that Colonial National Historical park has numerous problems with exotic plant species including Johnson grass (*Sorghum halapense*), Canadian thistle (*Carduus arvensis*), kudzu (*Pueraria lobata*), bamboo (*Phyllostachys aurea*), tree of heaven (*Ailanthus altissima*) and empress tree (*Paulownia tomentosa*).

Of the exotic plant species noted within the study areas, perhaps the species presenting the greatest threat to rare plants and communities is eulalia (*Microstegium vimineum*). While controlling this species is desirable, the ramifications of large scale herbicide treatment for control may not be practical in attempting to maintain rare plant populations concurrently. Other species, which are less widespread (e.g., oriental hawksbeard, common reed), may be decisively controlled using manual removal techniques and/or direct application of select herbicides.

Fact sheets with information on habitat, distribution, identification, threats, and control of *Lonicera japonica*, *Microstegium vimineum*, *Ligustrum sinense*, *Phragmites australis*, *Elaeagnus umbellata*, *E. angustifolia*, and *Alliaria petiolata* are included in Appendix 4.

Several exotic animal species was noted during 1997 zoological surveys. European Starlings and House Sparrows were noted in surrounding developed areas of Cheatham Annex and CNHP. These species may displace native birds in developed areas and along edge habitats through competition for nesting space, but are not expected to be as problematic within extensive natural habitats. A mating pair of mute swans was found guarding a nest near the southeastern most end of Cheatham Pond. This species may be extremely defensive of breeding territory, potentially displacing native waterfowl. Wild populations of this species in the eastern U. S. are apparently growing in numbers (National Geographic Society, 1987).

Table 3. Status of exotic plant species noted within the Cheatham and Wormley Pond study areas.

Widespread or locally abundant species:

Common name	**Latin name**
eulalia	*Microstegium vimineum*
Japanese honeysuckle	*Lonicera japonica*
common reed	*Phragmites australis*
Chinese privet	*Ligustrum sinense*

Species noted but not seen in abundance:

Common name	**Latin name**
garlic mustard	*Alliaria petiolata*
autumn olive	*Elaeagnus umbellata* var. *parvifolia*
Beale's oregon-grape	*Mahonia bealei*
Oriental hawksbeard	*Youngia japonica* (= *Crepis japonica*)
basket grass	*Arthraxon hispidus*
English ivy	*Hedera helix*

REFERENCES

Belden, A. J., S. M. Roble, and D. J. Stevenson. 1995. Inventory for rare, threatened and endangered plant and animal species at Colonial National Historical Park. Natural Heritage Technical Report 95-5. Department of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia. 3 pp.

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APPENDIX FOUR

Target species and natural communities for the Natural Heritage Inventory of Cheatham and Wormley Pond Drainages

Plants:

mountain camelia	*Stewartia ovata*
bog twayblade	*Liparis loeselii*
sandpaper vervain	*Verbena scabra*
lax hornpod	*Mitreola petiolata*
Virginia least trillium	*Trillium pusillum* var. *virginianum*
fibrous bladderwort	*Utricularia striata*
Cuthbert turtlehead	*Chelone cuthbertii*
sweet pinesap	*Monotropsis odorata*
American wisteria	*Wisteria frutescens*

Animals:

tidewater interstitial amphipod	*Stygobromus araeus*
tidewater amphipod	*Stygobromus indentatus*

Communities:

Coastal Plain calcareous seepage swamp
Basic mesic forest
Dry Calcareous Forest/Woodland (Coastal Plain subtype)